

## Fractures About the Elbow in Children

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### SUMMARY

*The authors report clinical experiences in the treatment of 135 cases of fractures of the elbow region in children in which 60 cases have been followed to an end-result.*

*A detailed mode of treatment for supracondylar fractures, fractures of the medial epicondyle, and fractures of the lateral condyle and capitellum is discussed.*

*The pitfalls in treatment and causes of poor results are detailed.*

**F**RACTURES of the elbow region in childhood are commonplace. Good results are not. Early recognition of trouble will reduce the number of poor late results.

During a recently ended five-year period, 135 cases of fracture of the elbow in children were observed on the Stanford orthopedic service of the San Francisco City and County Hospital. To date, 60 cases have been followed in the out-patient department to an end result. In all cases the injury was acute, and initial and subsequent treatment was carried out on the Stanford orthopedic service. The follow-up period has been up to four years. It is acknowledged that this is a relatively short follow-up period, but it is felt that it is sufficient to permit some conclusions with regard to complications.

This discussion will be limited to supracondylar fractures, fractures of the lateral condyle and capitellum, and fractures of the medial epicondyle.

**Supracondylar Fractures.** Brewster defined this fracture as any transverse fracture within an inch of the articular surface of the lower end of the humerus. This excludes the oblique fractures of the external condyle and capitellum and the epiphyseal separations of the medial epicondyle.

In the present series 32 cases were studied to an end result. The age of patients was from 3 to 10 years, the averaging age 6.1 years. The cases were equally divided as to the right and left arm, but no statistics are available as to major or minor arm ratio. There were 23 boys and nine girls in this group. In 28 cases the treatment was immediate closed reduction and immobilization in flexion. Traction suspension, after the manner of Dunlop, was used in three cases in which pronounced swelling of the soft tissues precluded the application of a cast with the elbow in a flexed position at the time of the initial treatment. When the swelling subsided,



Figure 1.—Recurrence of posterior displacement of distal fragment due to inadequate immobilization. Loss of usual 20° anterior tilt has resulted.

closed reduction and plaster immobilization were utilized in two of these three cases. All patients with fracture about the elbow are admitted to the hospital. They are observed closely until danger of ischemia is past. There were no complications due to ischemia. In two cases in this series, open reduction was necessary.

To evaluate the end result, the following criteria were applied: If the fractured elbow was clinically or radiographically indistinguishable from the opposite uninjured elbow, the result was rated as excellent. This was the result in 25 cases in this group. A good result was one in which only a minimal amount of restriction of extension was present. There were six such cases. In none of them was there more than 15 degrees of restriction. A poor result was one in which by both clinical and radiographic means some anatomical disturbance was observed. In one case a cubitus varus deformity resulted from a growth disturbance of the medial condyle.

In treating a fracture of this type, certain normal anatomical relationships must be recognized and restored. The distal articular process of the humerus normally has an anterior tilt, which approximates 20 to 30 degrees. Unless this tilt is restored, function of the joint will be restricted (Figures 1 and 2). A persistent posterior displacement will result in loss of flexion, and anterior displacement in restriction of extension. Once the distal fragment has been restored, immobilization in flexion is necessary to maintain reduction. The amount of flexion that can

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be achieved at the initial treatment is determined by the extent of hemorrhage into the antecubital space. With the gradual decrease in swelling in the antecubital space, flexion of the elbow can be increased without impairing the radial pulse. The proper amount of flexion and position of immobilization is achieved when the thumb of the injured extremity can be placed comfortably against the neck on the uninjured side. This position must be attained within the first two weeks and maintained with a sling for a minimum of six weeks. In this classical Jones' position (Figure 3), the weight of the forearm cannot act as a lever to produce posterior displacement of the fragment. In one patient recurrence of posterior displacement of the distal



Figure 2.—Restoration by osteotomy of anterior 20° tilt of distal fragment.

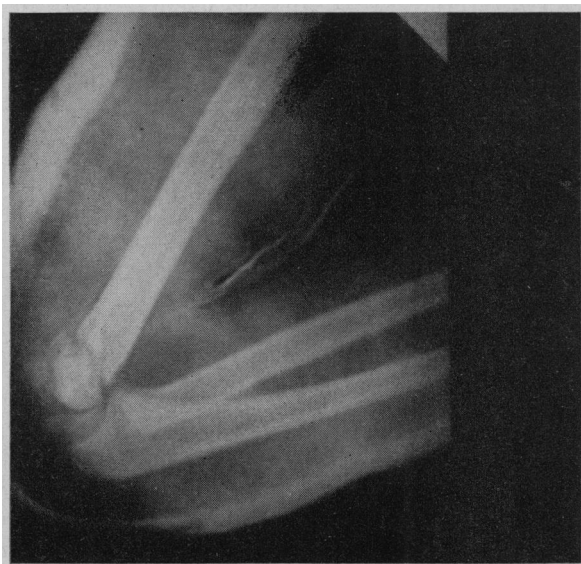


Figure 3.—Illustrating proper amount of flexion to insure obtaining the classical Jones' position.

fragment resulted from inadequate flexion and too short a plaster cast. Osteotomy, two years after initial reduction, was necessary for a final good result.

Rotation of the distal fragment in relation to the shaft of the humerus will result in an abnormal axis for motion unless realigned. Malalignment changes the carrying angle and results in permanent weakness in lifting power of the arm. In one case, open reduction had to be carried out to achieve proper coronal alignment. At operation, a sharp spicule of the distal fragment was observed to be imbedded in the tendinous expansion of the triceps, holding the lateral condylar portion posteriorly. Reduction was maintained by two-point fixation, using one chromic suture through periosteum and one Kirschner wire drilled obliquely across the fragment into the medial cortex of the shaft. Sixteen months after operation, loss of the terminal 10 degrees of extension was the sole remaining disability. This was considered a good end result.

*Fractures of the Lateral Condyle and the Capitellum.* Eleven patients with fractures of this kind were followed to end results. The average age of patients—eight boys and three girls—was 7.5 years. The right elbow was involved in five cases and the left in six. Seven were treated by closed means, and four by open reduction. In all cases in which treatment was by closed means, there was minimal or no observable displacement of the fragment, and results were excellent. Open reduction was carried out in four cases in which displacement of the fragment was observed (Figure 4). In three cases the result was excellent. In the other, 18 months after operation there was a 10-degree cubitus valgus deformity and a 5-degree restriction of extension. This was the sole poor result of the series. Although there was no evidence by x-ray of vascular impairment to the lateral condyle in this case, there was inequality of growth between the medial and lateral epiphyses.

It would seem from this series that when minimal displacement exists, good functional results can be obtained by closed means. It is necessary, however, to immobilize the arm securely to prevent displacement of the fragment by the pull of the extensor muscle group. In cases of displacement, open reduc-

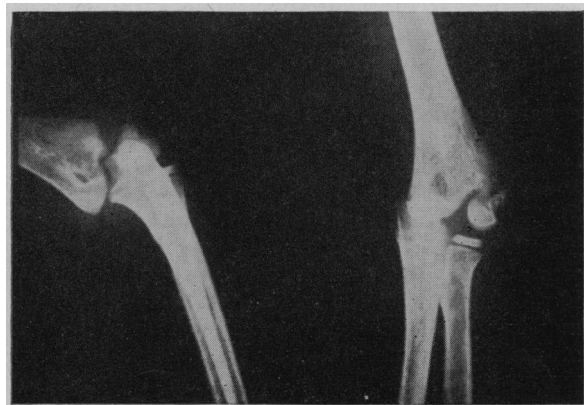


Figure 4.—Showing rotational displacement of lateral condylar fragment which requires operation and internal fixation to restore alignment.



Figure 5.—Inequality of growth of medial condyle despite x-ray evidence of lack of vascular impairment, 10° cubitus varus is present.



Figure 6.—Delayed growth arrest of trochlea. Two years after fracture.

tion is indicated. In light of the fact that the lateral condyle in children is composed primarily of a large cartilaginous mass, the need for reduction under direct vision is evident. Frequently, it cannot be ascertained from x-ray films how much rotation of the fragment is present, as the only visible fragment is the circular ossification center. Open reduction must be carried out with a minimal disruption of the soft tissue attachments in order to preserve the blood supply to the detached fragment. Growth disturbances are inevitable if a fragment is avascular, despite anatomical reduction. The method of internal fixation is of no importance provided it is adequate and does not interfere with growth of the epiphysis.

*Fractures of the Medial Epicondyle.* Fractures, or epiphyseal separations, of the medial epicondyle are more common than fractures of the medial condyle. This is fortunate, for if fracture lines extend into the condylar area the prognosis is grave (Figure 5). In the present series, 17 cases of fracture of the medial epicondyle were observed. In five the medial

condyle was involved. Fractures of this kind occurred in a slightly older age group; the average age of the patients was 11.7 years. This is understandable as the epiphysis in this region appears after the fifth year. There were nine boys and eight girls. Six patients had fracture of the right arm, and 11 of the left. In 13 cases displacement was minimal and treatment was by closed means. In four cases in which the fracture line extended into the condyle and displacement was present, primary open reduction and internal fixation were carried out. The only poor result was caused by failure to restore the displaced medial condyle to its anatomical position at the time of operation. In that case there was also lateral dislocation of the elbow joint with anterior displacement of the trochlear epiphysis which was treated by closed reduction. Good restoration of alignment with 2 mm. separation of the condylar fragment was observed in postreduction x-ray films. Two years later a well-established growth disturbance of the trochlea was noted (Figure 6). There was a cubitus varus deformity of ten degrees, with restricted motion. It is probable the injury could have been treated more effectively by open operation.

#### DISCUSSION

Any fracture about the elbow joint of a child is a serious problem. A real possibility of growth disturbance with resulting disability is always present. Every poor result in the series here reported was associated with some interference with growth. To avoid poor results, anatomical restoration of alignment and reapposition of fragments is imperative. Frequently, open reduction is necessary to achieve this goal in cases of condylar fractures with displacement. The reduction must be accomplished within the first two weeks. After this time union has progressed so far that alterations in position cannot be achieved without a major disruption of the healing process. The belief that an incomplete reduction will be corrected by the remodeling process of growing bone is not justified. The reduction must be maintained in the Jones' position for a minimum of six weeks. Careful supervision in the initial stages of treatment can avoid complications of ischemia. The earliest sign of trouble from ischemia is pain localized to the muscles of the forearm on extension of the fingers.

In the postimmobilization period, function can be restored best by active use. The authors believe there is no place for physiotherapy in the treatment of fractures about the elbow. Forceful manipulations of a stiffened joint or the carrying of heavy objects will tend only to increase deformities.

To detect the late arrest or disturbance of growth in the epiphysis of the trochlea or capitellum, all patients must be followed for three to five years. Such alterations in growth may occur despite the best of care.

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#### REFERENCE

1. Brewster, A. H., and Karp, M.: Fractures in the region of the elbow in children. An end result study, *Surg., Gynec., & Obst.*, 71:643-649, Nov. 1940.